CLAIMS

1. A producing method of an electrostatic sucking type liquid jetting head having a plurality of nozzles for jetting liquid solution as a droplet from a nozzle edge, comprising:

forming a plurality of jetting electrodes on a base plate for applying a jetting voltage;

forming a photosensitive resin layer on the base plate so as to cover all of the plurality of jetting electrodes;

making the photosensitive resin layer stand with respect to the base plate so as to correspond to each jetting electrode and so as to form the photosensitive resin layer in a nozzle shape having a nozzle diameter of not more than 30μm, by exposing and developing the photosensitive resin layer;

forming an in-nozzle passage so as to establish a communication from an edge portion of the nozzle to the jetting electrode in the nozzle; and

connecting the in-nozzle passage to a liquid solution supplying channel corresponding to the plurality of nozzles.

2. The producing method of the electrostatic sucking type liquid jetting head of claim 1, further

comprising:

making at least an inside surface of each liquid solution supplying channel insulating; and

providing a control electrode for controlling a meniscus position of the liquid solution at the edge portion of the nozzle, in the liquid solution supplying channel.

3. The producing method of the electrostatic sucking type liquid jetting head of claim 2, wherein the liquid solution supplying channel is formed from a piezoelectric material.

4. The producing method of the electrostatic sucking type liquid jetting head of any one of claims 1 to 3, wherein the nozzle diameter of the nozzle is less than 20μm.

5. The producing method of the electrostatic sucking type liquid jetting head of claim 4, wherein the nozzle diameter of the nozzle is not more than 10μm.

6. The producing method of the electrostatic sucking type liquid jetting head of claim 5, wherein the nozzle diameter of the nozzle is not more than 8μm.

7. The producing method of the electrostatic sucking type liquid jetting head of claim 6, wherein the nozzle diameter of the nozzle is not more than 4μm.

8. The producing method of the electrostatic sucking type liquid jetting head of any one of claims 1 to 7, wherein the photosensitive resin layer is a fluorine-containing resin.

9. A driving method of the electrostatic sucking type liquid jetting head produced by the producing method of any one of claims 1 to 8, comprising:

making the edge portion of each nozzle face the base member;

supplying the chargeable liquid solution, to each liquid solution supplying channel; and

applying the jetting voltage to each of the plurality of jetting electrodes.

10. The driving method of the electrostatic sucking type liquid jetting head of claim 9, wherein the liquid solution in each in-nozzle passage forms a state of rising from the edge portion of the nozzle in a convex shape.

11. The driving method of the electrostatic

sucking type liquid jetting head of claim 10, further comprising:

applying the jetting voltage to the jetting electrode when the liquid solution in each in-nozzle passage forms the state of rising from the edge portion in the convex shape.

12. An electrostatic sucking type liquid jetting apparatus having the electrostatic sucking type liquid jetting head produced by the producing method of any one of claims 1 to 8, being capable of placing the edge portion of each nozzle to face the base member, comprising:

a liquid solution supplying section for supplying the chargeable liquid solution to each in-nozzle passage; and

a jetting voltage applying section for individually applying the jetting voltage to the plurality of jetting electrodes.

13. The electrostatic sucking type liquid jetting apparatus of claim 12, further comprising a convex meniscus forming section for forming a state where the liquid solution of each in-nozzle passage rises in a convex shape from the edge portion of the nozzle.

14. The electrostatic sucking type liquid jetting apparatus of claim 13, wherein the jetting voltage applying section applies the jetting voltage to the jetting electrodes when the convex meniscus forming section forms the state where the liquid solution of each in-nozzle passage rises in the convex shape from the edge portion of the nozzle.

15. The electrostatic sucking type liquid jetting apparatus of claim 13 or claim 14, wherein the convex meniscus forming section comprises a piezoelectric element being so placed as to correspond to each nozzle, and

the piezoelectric element changes a shape thereof for changing a pressure of the liquid solution of the in-nozzle passage.

16. A producing method for producing a nozzle plate having a plurality of nozzles for jetting liquid solution as a droplet from a nozzle edge, comprising:

forming a plurality of jetting electrodes on a base plate for applying a jetting voltage;

forming a photosensitive resin layer on the base plate so as to cover all of the plurality of jetting electrodes;

making the photosensitive resin layer stand with

respect to the base plate so as to correspond to each jetting electrode and so as to form the photosensitive resin layer in a nozzle shape having a nozzle diameter of not more than 30μm, by exposing and developing the photosensitive resin layer; and

forming an in-nozzle passage so as to establish a communication from an edge portion of the nozzle to the jetting electrode in the nozzle.

17. The producing method of the nozzle plate of claim 16, wherein the nozzle diameter of the nozzle is less than 20μm.

18. The producing method of the nozzle plate of claim 17, wherein the nozzle diameter of the nozzle is not more than 10μm.

19. The producing method of the nozzle plate of claim 18, wherein the nozzle diameter of the nozzle is not more than 8μm.

20. The producing method of the nozzle plate of claim 19, wherein the nozzle diameter of the nozzle is not more than 4μm.

21. The producing method of the nozzle plate of

any one of claims 16 to 20, wherein the photosensitive resin layer is a fluorine-containing resin.

22. A liquid jetting apparatus comprising:

a nozzle having an edge portion facing a base plate having a receiving surface for receiving a jetting of a droplet of charged liquid solution, the nozzle having an inside diameter of not more than 30μm, for jetting the droplet from the edge portion;

a jetting voltage applying section for applying a jetting voltage to the liquid solution in the nozzle; and

a liquid solution supplying section for controlling a supplying pressure of the liquid solution so as to locate a liquid level within the nozzle while the apparatus is on standby, by supplying the liquid solution in the nozzle.

23. The liquid jetting apparatus of claim 22, further comprising a stirring voltage applying section for applying a voltage for stirring a charged component in the liquid solution, to the liquid solution while the apparatus is on standby.

24. The liquid jetting apparatus of claim 23, wherein the stirring voltage applying section is structured by structuring a hardware in common with the

jetting voltage applying section so as to be capable of carrying out an operation of applying a repeating voltage oscillating within a voltage range smaller than a jetting start voltage, to the liquid solution.

25. The liquid jetting apparatus of any one of claims 22 to 24, wherein

an inside surface of a passage of the nozzle is at least insulating, and

a fluid supplying electrode is placed at a circumference of the liquid solution in the passage and outside of a portion of the insulating inside surface.

26. The liquid jetting apparatus of any one of claims 22 to 25, wherein an inside diameter of the nozzle is less than 20μm.

27. The liquid jetting apparatus of claim 26, wherein the inside diameter of the nozzle is not more than 10μm.

28. The liquid jetting apparatus of claim 27, wherein the inside diameter of the nozzle is not more than 8μm.

29. The liquid jetting apparatus of claim 28,

wherein the inside diameter of the nozzle is not more than 4μm.

30. The liquid jetting apparatus of any one of claims 22 to 29, wherein a coating having higher water repellency than the base member of the nozzle is formed at a circumferential portion of a jet opening of the nozzle.

31. The liquid jetting apparatus of claim 30, wherein a coating having higher water repellency than the base member of the nozzle is formed at an inside surface of the nozzle.

32. The liquid jetting apparatus of any one of claims 22 to 29, wherein the nozzle is formed from a fluorine-containing photosensitive resin.

33. A liquid jetting apparatus comprising:

a nozzle having an edge portion facing a base plate having a receiving surface for receiving a jetting of a droplet of charged liquid solution, the nozzle having an inside diameter of not more than 30μm, for jetting the droplet from the edge portion;

a liquid solution supplying section for supplying the liquid solution in the nozzle;

a jetting voltage applying section for applying a jetting voltage to the liquid solution in the nozzle; and

a coating formed on an edge surface of the nozzle where a jet opening of the nozzle opens, in a circular shape surrounding the jet opening, the coating having higher water repellency than a nozzle base member,

wherein the apparatus jets the droplet when a liquid level of the liquid solution is in a state of being in a convex meniscus shape at outside of the nozzle so as to make a diameter of the liquid level equal to an inside diameter of the coating.

34. A liquid jetting apparatus comprising:

a nozzle having an edge portion facing a base plate having a receiving surface for receiving a jetting of a droplet of charged liquid solution, the nozzle having an inside diameter of not more than 30μm, for jetting the droplet from the edge portion;

a liquid solution supplying section for supplying the liquid solution in the nozzle;

a jetting voltage applying section for applying a jetting voltage to the liquid solution in the nozzle; and

a coating formed on an edge surface of the nozzle where a jet opening of the nozzle opens, in a circular shape surrounding the jet opening, the coating having higher water repellency than an inside surface of the

nozzle,

wherein the apparatus jets the droplet when a liquid level of the liquid solution is in a state of being in a convex meniscus shape at outside of the nozzle so as to make a diameter of the liquid level equal to an inside diameter of the coating.

35. A liquid jetting apparatus comprising:

a nozzle having an edge portion facing a base plate having a receiving surface for receiving a jetting of a droplet of charged liquid solution, the nozzle being formed from a fluorine-containing photosensitive resin, the nozzle having an inside diameter of not more than 30μm, for jetting the droplet from the edge portion;

a liquid solution supplying section for supplying the liquid solution in the nozzle; and

a jetting voltage applying section for applying a jetting voltage to the liquid solution in the nozzle.

36. A liquid jetting apparatus comprising:

a nozzle having an edge portion facing a base plate having a receiving surface for receiving a jetting of a droplet of charged liquid solution, the nozzle having an inside diameter of not more than 30μm, for jetting the droplet from the edge portion;

a liquid solution supplying section for supplying

the liquid solution in the nozzle; and

a jetting voltage applying section for applying a jetting voltage to the liquid solution in the nozzle,

wherein the liquid solution takes a contact angle of not less than 45 degree, with respect to a circumferential material of the jet opening.

37. A liquid jetting apparatus comprising:

a nozzle having an edge portion facing a base plate having a receiving surface for receiving a jetting of a droplet of charged liquid solution, the nozzle having an inside diameter of not more than 30μm, for jetting the droplet from the edge portion;

a liquid solution supplying section for supplying the liquid solution in the nozzle; and

a jetting voltage applying section for applying a jetting voltage to the liquid solution in the nozzle,

wherein the liquid solution takes a contact angle of not less than 90 degree with respect to a circumferential material of the jet opening.

38. A liquid jetting apparatus comprising:

a nozzle having an edge portion facing a base plate having a receiving surface for receiving a jetting of a droplet of charged liquid solution, the nozzle having an inside diameter of not more than 30μm, for jetting the

droplet from the edge portion;

a liquid solution supplying section for supplying the liquid solution in the nozzle; and

a jetting voltage applying section for applying a jetting voltage to the liquid solution in the nozzle,

wherein the liquid solution takes a contact angle of not less than 130 degree with respect to a circumferential material of the jet opening.

39. The liquid jetting apparatus of any one of claims 33 to 38, wherein the inside diameter of the edge portion of the nozzle is less than 20μm.

40. The liquid jetting apparatus of claim 39, wherein the inside diameter of the edge portion of the nozzle is not more than 10μm.

41. The liquid jetting apparatus of claim 40, wherein the inside diameter of the edge portion of the nozzle is not more than 8μm.

42. The liquid jetting apparatus of claim 41, wherein the inside diameter of the edge portion of the nozzle is not more than 4μm.

43. A liquid jetting apparatus comprising:

a nozzle having a nozzle diameter of not more than 30μm (micrometer);

a supplying passage for guiding liquid solution to the nozzle; and

a jetting voltage applying section for applying a jetting voltage to the liquid solution in the nozzle,

wherein the apparatus jets the charged liquid solution as a droplet from an edge portion of the nozzle, to a base member being so placed as to face the edge portion based on the applying of the jetting voltage to the liquid solution in the nozzle by the jetting voltage applying section, and

the apparatus further comprises a cleaning device for circulating cleaning solvent in the nozzle, or in the nozzle and in the supplying passage, for cleaning the nozzle, or the nozzle and the supplying passage with the cleaning solvent.

44. The liquid jetting apparatus of claim 43, wherein the cleaning device circulates the cleaning solvent along a supplying direction of the liquid solution to the nozzle.

45. The liquid jetting apparatus of claim 44, wherein the cleaning device comprises:

a cap member for covering an outside surface of the

nozzle from a side of the edge portion; and

a sucking pump for sucking inside of the nozzle via the cap member.

46. The liquid jetting apparatus of any one of claims 43 to 45, wherein the cleaning device comprises a head portion having a jetting hole capable of jetting the cleaning solvent toward an outside surface of the nozzle.

47. The liquid jetting apparatus of claim 45, wherein a jet hole capable of jetting the cleaning solvent toward the outside surface of the nozzle is placed at the cap member, and

the sucking pump sucks the cleaning solvent jetted to the outside surface from the jet hole.

48. The liquid jetting apparatus of any one of claims 43 to 47, wherein a vibration having high frequency is given to the cleaning solvent.

49. The liquid jetting apparatus of any one of claims 43 to 48, further comprising:

a liquid solution containing section for containing the liquid solution to be supplied to the nozzle via the supplying passage; and

a vibration generating device for dispersing fine

particles included in the liquid solution by giving the vibration to the liquid solution contained in the liquid solution containing section.

50. The apparatus of claim 49, wherein the vibration given by the vibration generating device is a supersonic wave.

51. The liquid jetting apparatus of any one of claims 43 to 50, wherein the cleaning device is capable of stopping the circulating of the cleaning solvent in a state where the cleaning solvent fills the nozzle, or the nozzle and the supplying passage, when the jetting of the liquid solution from the nozzle is stopped.

52. The liquid jetting apparatus of any one of claims 43 to 51, wherein the nozzle diameter is less than 20μm.

53. The liquid jetting apparatus of claim 52, wherein the nozzle diameter is not more than 10μm.

54. The liquid jetting apparatus of claim 53, wherein the nozzle diameter is not more than 8μm.

55. The liquid jetting apparatus of claim 54,

wherein the nozzle diameter is not more than 4μm.